IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Jens-Christian D. Meiners

Serial No.: 10/672,254

Filed: September 26, 2003

Group Art Unit: 1732

Examiner: Angela Y. Ortiz

For: PACKAGING TECHNIQUE FOR ELASTOMERIC MICROFLUIDIC CHIPS AND MICROFLUIDIC DEICE PREPARED THEREBY

Attorney Docket No.: UOM 0275 PUSP

CORRECTED APPEAL BRIEF UNDER 37 C.F.R. § 41.37

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Sir:

Applicant hereby files their Appeal Brief in response to the Notification of Non-Compliant Appeal Brief mailed May 17, 2007.

This is an Appeal Brief from the final rejection of claims 21-40 of the Office Action mailed on April 18, 2006 for the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is The Regents of the University of Michigan ("Assignee"), a corporation organized and existing under the laws of the state of Michigan, and having a place of business at 3003 South State Street, Ann Arbor, Michigan 48109, as set forth in the assignment recorded in the U.S. Patent and Trademark Office on June 12, 2003 at Reel 014158/Frame 0067.

II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to the Appellant, the Appellant's legal representative, or the Assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-20 are cancelled in this application. Claims 21-40 are pending in this application. Claims 21-40 have been rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

An amendment after final rejection was not filed .

V. SUMMARY OF CLAIMED SUBJECT MATTER

In an embodiment of the present invention as disclosed in independent claim 21, a process for the preparation of a robust microfluidics device having at least one interconnect is provided. The process of this embodiment comprises a step in which at least one elastomeric portion is positioned onto a rigid substrate. (Specification, p. 5, ll. 8-9). The elastomeric portion either contains or defines in conjunction with a further elastomeric portion or a substrate at least one fluid passage. (Specification, p. 5, ll. 10-14). At least one interconnect is provided to said elastomeric portion. (Specification, p. 6, ll. 3-4). The elastomeric portion(s)

and said interconnect(s) are then encapsulated with a curable resin which exhibits volumetric contraction upon curing. (Specification, p. 6, ll. 14-15, p. 7, ll. 29-30). Characteristically, the resin surrounds the elastomer portion and at least a portion of said substrate such that said elastomeric portion(s) are surrounded by resin on all sides where interconnect(s) are present. Finally, the curable resin is cured to provide an encapsulated microfluidics device such that the curable resin presses the elastomeric portion against said substrate during cure of said curable resin. (Specification, p. 7, ll. 29-30, p. 8, ll. 14-17).

In another embodiment of the present invention as disclosed in independent claim 38, a process for the preparation of a robust microfluidics device having at least one interconnect is provided. The method of this embodiment comprises a step in which at least one elastomeric portion is positioned onto a rigid substrate. (Specification, p. 5, ll. 8-9). The elastomeric portion contains or defines together with a further elastomeric portion or a substrate at least one fluid passage. (Specification, p. 5, ll. 10-14). At least one interconnect is provided to said elastomeric portion. (Specification, p. 6, ll. 3-4). The elastomeric portion(s) and the interconnect(s) are encapsulated with a thermoset resin which exhibits volumetric contraction upon curing such that the resin surrounds said elastomer portion and at least a portion of said substrate. (Specification, p. 6, ll. 14-15, p. 7, ll. 29-30). Finally, the thermoset resin is cured to provide an encapsulated microfluidics device such that the curable resin presses the elastomeric portion against the substrate during cure of the thermoset resin. (Specification, p. 7, ll. 29-30, p. 8, ll. 14-17).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 34-37 stand rejected under 35 U.S.C. 102(b) as being anticipated by admitted prior art as set forth on pages 1-3 of the instant specification.

Claims 21-33 and 38-40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth on pages 1-3 of the present specification, in view of Bauer (U.S. Pat. No. 4,304,749).

VII. ARGUMENT

A. Claims 34-37 Are Patentable Under 35 U.S.C. § 102(b) Over Alleged Admitted Prior Art

The Examiner's analysis in support of the present invention is conspicuously deficient in its failure to consider the encapsulation step of the present invention. Claims 34-37 depend from independent claim 21. Independent claim 21 includes a step of "encapsulating said elastomeric portion(s) and said interconnect(s) with a curable resin which exhibits volumetric contraction upon curing, said resin surrounding said elastomer portion and at least a portion of said substrate." In order to appreciate the deficiency of the Examiner's rejection, an understanding of the term "interconnect" which appears in independent claim 21 is required. The specification states:

> By "interconnect" is meant a tube, wire, cable, optical fiber, etc., which is used to supply fluid to or receive fluid from the device, or through which a monitoring signal is passed or capable of being passed.
>
> Specification, p. 7, ll. 21-23

Therefore, one example of an interconnect is the tubing described in the background section of the present application. The alleged admitted prior art fails to include encapsulation of tubing as required by the limitation – "encapsulating said elastomeric portion(s) and said interconnect(s) with a curable resin which exhibits volumetric contraction upon curing, said resin surrounding said elastomer portion and at least a portion of said substrate." Moreover, claim 21 requires that the elastomeric portion(s) "on all sides where interconnect(s) are

present." Since claims 34-37 depend from claim 21, the microfluidic devices of these claims necessarily include an encapsulant surrounding the elastomeric portion(s) "on all sides where interconnect(s) are present."

For the convenience of the Board, each of the passages in the background section of the present invention mentioning interconnects or tubing are reproduced below:

> Thus, layer 23 will require **multiple connections** to external liquid and gas lines, typically of very fine diameter tubing, in this case illustrated as having **been embedded into layer 20 during casting**. Figure 3 is discussed below.
>
> While such microfluidic devices have been used for some time, their construction has been problematic. The elastomer layers tend to be relatively fragile, and due to their elastomeric nature, are not ideal materials to embed small tubing required for supply and exit of fluids. In many devices, the flow rate is critical, and may change when even minor stress is exerted on the tubing. Other attached components such as optical fibers used for a variety of detection methods may have their physical properties changed as a result of such stress as well.
>
> Specification, p. 3, ll. 14-24 (emphasis added).
>
> In addition to these drawbacks, such microfluidic devices tend to be quite fragile, and must be handled carefully to avoid damage to the device or the interconnects.
>
> It would be desirable to provide a method for the fabrication of elastomeric microfluidic which does not require baking, and which provides a robust structure wherein interconnects with the device passages or of monitoring devices such as optical fibers and the like are rendered resistant to distortion by stresses imposed on the device or interconnects.
>
> Specification, p. 4, ll. 1-8.

The only structures provided in the background section have interconnects embedded in a layer. In the present invention, a completely different structure is provided. Specifically, in the present invention there is an elastomeric portion, an interconnect to the elastomeric portion, and an encapsulation that encapsulates the elastomeric portion and the interconnect together. The elastomeric portion partially defines at least at least one fluid passage (Claim 21). The elastomeric portion is analogous to the layer described in the background section. It should be evident that this is a different structure than having an interconnect embedded in a layer. Instead, the present invention describes a portion of a layer and an interconnect embedded in a resin. Moreover, it must also be appreciated that the resin has very special characteristics. Specifically, the resin is a curable resin that exhibits volumetric contraction upon curing. Utilization of such a resin results in a specific physical structure, that is, the residues of a resin exhibits volumetric contraction upon curing.

Accordingly, since such an encapsulant and the use of such a resin is lacking in the alleged prior art, claims 34-37 are allowable under 35 U.S.C. 102(b) as being anticipated by admitted prior art as set forth on pages 1-3 of the instant specification.

B. Claims 21-33 and 38-40 Are Patentable Under 35 U.S.C. § 103(a) Over U.S. Pat. No. 4,304,749

Appellants have explained that the alleged prior art does not teach the encapsulation of independent claim 21. Similarly Bauer does not teach such an encapsulation. It is ambiguous as to whether or not Bauer teaches any type of encapsulation. The Examiner states with regard to Bauer:

> The added secondary reference teaches as conventional the feature of forming a fluidic structure using a polymeric material that does not require baking, having contracting properties as claimed. A cover 23 and substrate 22 are provided adjacent one another such that there is provided a fluid passage there

> between. A thermoset plastic resin is injected into the mold cavity to encapsulate the assembly, such that it contracts upon solidification.
>
> Office Action dated April 18, 2006.

Although the Examiner states that Bauer describes an encapsulation, review of the passage relied upon reveals that this is not the case. The cited passage states:

> . . .which include an injection inlet opening 84. When plastic is injected into opening 84 it flows through and fills channels 81 and holes 78 and 79. Upon solidifying the plastic in the holes applies a shrinkage stress compression force which holds the body member and cover plate together. In this regard it is noted that the wide-to-narrow configuration of holes 78, 79 permits the **solidified plastic therein to act like a rivet in joining the two elements together**. Aiding this function is the expansion of collar 80 against the walls of hole 78 by the solidifying plastic. The final assembly (as seen in FIG. 8) is a compact one piece unit sealed by a simple plastic injection step.
>
> Bauer, col 5, 1-15 (emphasis added).

Clearly, the passage relied upon by the Examiner does not describe an encapsulation. Instead, this passage describes a configuration in which two elements are held together by a rivet-like process. Webster-Merriam Online Dictionary provides the following definition for encapsulate- "1 : to enclose in or as if in a capsule <a pilot encapsulated in the cockpit>." Since Bauer does not disclose encapsulation as required by independent claims 21 and 38, the Examination's rejection under 103(a) should be reversed.

Accordingly, for at least this reason claims 21-33 and 38-40 are allowable under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth on pages 1-3 of the present specification, in view of Bauer (U.S. Pat. No. 4,304,749).

1. Claims 21-33 are Separately Patentable Under 35 U.S.C. § 103(a) Over U.S. Patent No.4,304,749

Independent claim 21 explains the extent of the encapsulation - "said resin surrounding said elastomer portion and at least a portion of said substrate such that said elastomeric portion(s) are surrounded by resin on all sides where interconnect(s) are present." None of the methods for binding the elements of the fluidic device of Bauer together provide such an encapsulation. In particular, neither the alleged admitted prior art nor Bauer describe a fluidic device with interconnects such that an elastomer is surrounded by an encapsulate on all sides where such interconnects are present.

The Examiner's characterization that the limitation "such that said elastomeric portion(s) are surrounded by resin on all sides where interconnect(s) are present" as "desired results" is somewhat ridiculous. This describes the manner in which the resin is applied. It can be applied to one, two or all sides. The present invention requires that **all** sides be surrounded. The resin is not shot at the interconnects with the hope that it covers all sides. It must be directed in a manner such that all sides are encapsulated. Clearly, this limitation is not a "desired result," instead, it is a **directed outcome**.

Accordingly, for at least this reason claims 21-33 are allowable under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth on pages 1-3 of the present specification, in view of Bauer (U.S. Pat. No. 4,304,749).

The fee of $310.00 to cover the Petition fee of $60.00 under 37 C.F.R. § 1.136(a) and the Appeal Brief fee of $250.00 as applicable under the provisions of 37 C.F.R. § 41.20(b)(2) has been previously submitted. Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 02-3978.

Respectfully submitted,

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Enclosure - Appendices

VIII. CLAIMS APPENDIX

1 - 20. (Cancelled)

21. A process for the preparation of a robust microfluidics device having at least one interconnect, comprising:

positioning at least one elastomeric portion onto a rigid substrate, said elastomeric portion containing, or said elastomeric portion defining together with a further elastomeric portion or with said substrate, at least one fluid passage;

providing at least one interconnect to said elastomeric portion;

encapsulating said elastomeric portion(s) and said interconnect(s) with a curable resin which exhibits volumetric contraction upon curing, said resin surrounding said elastomer portion and at least a portion of said substrate such that said elastomeric portion(s) are surrounded by resin on all sides where interconnect(s) are present; and

curing said curable resin to provide an encapsulated microfluidics device, whereby said curable resin presses said elastomeric portion against said substrate during cure of said curable resin.

22. The process of claim 21 wherein said substrate is glass.

23. The process of claim 21 wherein said interconnect is a fluid supply tubing or fluid receiving tubing.

24. The process of claim 21 wherein said interconnect is a fiber optical cable.

25. The process of claim 21 wherein at least two fluid supply and/or fluid receiving tubing interconnects are present.

26. The process of claim 21 wherein said encapsulating resin is a transparent resin.

27. The process of claim 21 wherein said encapsulating resin is an epoxy resin.

28. The process of claim 21, wherein said curable resin is a thermosettable resin.

29. The process of claim 21, wherein said curable resin is a transparent thermosettable resin.

30. The process of claim 21, wherein said curable resin is poured onto said elastomeric portion and substrate.

31. The process of claim 30, wherein said elastomeric portions and substrate are positioned within an open cavity in a frame prior to pouring curing resin into the cavity.

32. The process of claim 21 wherein said substrate and said elastomeric portions are located within a cavity in a frame, and said encapsulating resin is introduced into said cavity.

33. The process of claim 32 wherein said frame is a two-part frame.

34. A microfluidics device prepared by the process of claim 21.

35. A microfluidics device prepared by the process of claim 24.

36. A microfluidics device prepared by the process of claim 26.

37. A microfluidics device prepared by the process of claim 21, wherein metal tubing interconnects which protrude from the encapsulated device in a defined configuration adapted to be inserted into correspondingly configured fluid supply lines are in fluid communication with one or more microfluidic passages in said device.

38. A process for the preparation of a robust microfluidics device having at least one interconnect, comprising:

positioning at least one elastomeric portion onto a rigid substrate, said elastomeric portion containing, or said elastomeric portion defining together with a further elastomeric portion or with said substrate, at least one fluid passage;

providing at least one interconnect to said elastomeric portion;

encapsulating said elastomeric portion(s) and said interconnect(s) with a thermoset resin which exhibits volumetric contraction upon curing, said resin surrounding said elastomer portion and at least a portion of said substrate; and

curing said thermoset resin to provide an encapsulated microfluidics device, whereby said curable resin presses said elastomeric portion against said substrate during cure of said thermoset resin.

39. The process of claim 38 wherein said substrate is glass.

40. The process of claim 38 wherein said interconnect is a fluid supply tubing or fluid receiving tubing.

IX. EVIDENCE APPENDIX

"None"

X. RELATED PROCEEDINGS APPENDIX

None